



# Nutritional Status in 6-59 Months Children and its Association with Water, Sanitation And Hygiene Practice in Panchapuri Municipality, Surkhet, Karnali Province, Nepal

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## ABSTRACT

**Background:** Childhood malnutrition is a critical public health concern in Nepal. The Karnali province is reported to have poor water, sanitation, and hygiene behavior. This study aimed to examine the association between safe water, sanitation and hygiene (WASH) practice and the nutritional status of children of Panchapuri municipality Surkhet, Karnali Province, Nepal.

**Methods:** A descriptive cross-sectional study design was conducted among 6 to 59-month-old children in Panchapuri municipality Surkhet, Karnali Province, Nepal from July 15, 2020, to 1st August 2020. This study included 168 households selected by using cluster random sampling and respondents were selected by using simple random sampling. Data were collected using a questionnaire from the parents, and an observation checklist. The weights and heights of children were taken using a Seca digital weighing scale and a wooden height board respectively. Anthropometric analysis was done using WHO Anthro version 3.2.2 software and other statistical analysis was conducted using SPSS software.

**Results:** Among 168 children the prevalence of wasting, stunting, and underweight is 4.8%, 12.5%, and 6% respectively. Most of the households (81.5%) had safe sources of drinking water whereas 18.5% of households were found to use unsafe sources of drinking water. The majority of households (62.5%) didn't use any methods of water purification before drinking or using the water for cooking purposes. All the households (100%) had toilets but 90% of households used improved types of toilets. Solid waste from about 80% of households was managed by burning whereas 6.5% of households threw the waste in an open place. Half of the total households managed the liquid waste in kitchen gardens whereas about 39% of households drained the liquid waste in rivers and streams and only about 11% of households drained wastewater in open places.

**Conclusion:** This study highlights the link between socio-demographics, WASH practices, and child nutrition. While wasting and stunting remain concerns, undernutrition has declined. Improved water, sanitation, and hygiene practices are essential to further reduce malnutrition among children.

**Keywords:** Hygiene; nutrition, sanitation, WASH

## BACKGROUND

Malnutrition is a global problem and unlike other evils, it is an increasing trend. Poor nutrition is characterized by stunting, wasting, and underweight. It is a major burden associated with children under five years worldwide. (1) It has both short-term and long-term adverse consequences. In the

short term for the individual, it is associated with ill health and is an immediate predictor of child mortality. around 45% of under-five mortality was attributable to undernutrition. (2) In the long term, it leads to impaired cognitive development poorer educational achievement, and economic productivity. (3) Malnutrition

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is a major cause of child illness and morbidity. Today the world faces a double burden of malnutrition that includes both undernutrition and overweight, especially in developing countries. It is estimated that the diseases due to poor water, sanitation and hygiene conditions have contributed to half of the undernutrition.(4) Poor nutritional intake during childhood indicates malnourishment and might experience a higher risk of mortality. It is well explained that the first five years of a child's life, including the nine months of pregnancy, is considered very crucial as the overall well-being of a child and further development occurs at this phase.(5) So, to ensure healthy growth, proper organ formation, immune system and cognitive development, adequate nutrition is very essential in early childhood.(6) Child growth has been recognized as an important indicator of nutritional status and health where underweight, stunting and wasting are used to measure the nutritional imbalances resulting in undernutrition.(7) Under-five are among such a group of children who are most susceptible to malnutrition. If a child is affected by severe acute malnutrition the chances of mortality due to Diarrhoea are ten times higher among children under five. Here water sanitation and hygiene environment play a critical role in the nutritional outcome, especially in stunting but the impacts on wasting are yet to be explored.(8) Access to WASH services is a fundamental component of healthy communities which has a good impact on nutrition. To achieve global nutrition targets in 2025 and the global goal for Health and WASH, greater investments in Nutrition and WASH are required. Access to safe drinking water and sanitation facilities has been declared as a basic human right by the United Nations in the year 2010.(9) Nepal has made significant progress in reducing child mortality; however, WASH-associated diseases remain among the top ten leading causes of morbidity and mortality in the country. After acute respiratory infection, diarrhea is the second largest killer disease among under-five children in Nepal.(10) The government of Nepal and its development partners are committed to addressing the complex problem of malnutrition. The government's development objectives are outlined in the constitution of Nepal, the Fourteenth Development Plan and the Sustainable Development Goals (SDGs). Economic growth, employment promotion, poverty alleviation, post-conflict reconstruction, social transformation and human resource development are the government's development priorities. Improving the nutritional status of its citizens is a major priority of the government. Improving nutrition involves interventions in health and other sectors; thus policies, strategies and plans of the health, agriculture, livestock, water and sanitation sectors emphasize good nutrition and food security. (11) The provision of safe water for drinking and domestic activities, and proper waste management and

health promotion activities to encourage protective healthy behavioral practices is termed as WASH. (12) In 2014, the second International Conference on Nutrition (ICN2) adopted the Rome Declaration on Nutrition and the Framework for Action which that three recommendations about WASH. The 2012 World Health Assembly on Comprehensive Implementation Plan on Maternal, Infants and Young Child Nutrition, also stressed the need for integrated actions including WASH.(4)The objective of study is to identify the nutritional status of 6 to 59 months children and its association with water sanitation and hygiene practice in Panchapuri Municipality, Surkhet.

## METHODS

**Study design and sampling strategy:** The study employed a quantitative approach, utilizing a cross-sectional design. It aimed to evaluate the nutritional status of children aged 6 to 59 months in Panchapuri municipality, Surkhet, and its correlation with water, sanitation, and hygiene (WASH) practices. Cluster sampling was employed, with each of the municipality's eleven wards treated as a cluster. From each ward, 16 eligible households were targeted using probability proportionate to size sampling, totaling 168 households. In instances where a ward did not provide 16 eligible households, adjacent wards were randomly selected to supplement the sample.

**Data collection tools and techniques:** Data was collected through individual face to face interview using structured questionnaires with the mothers. Observation was done for sanitation facilities. Anthropometric assessment (length, weight and height) was conducted in children aged 6 to 59 months children.

**A structured and semi-structured questionnaire:** Questionnaire (with reference from NDHS 2016 for under-nutrition, diarrhoea, water, sanitation and hygiene behaviour) was developed as a data collection tool. The questionnaire was first developed in English language and then translated into Nepali language and back translation to English and was compared. The prepared questionnaire was used during face-to-face interviews and an observation checklist was used during the observation of sanitation facilities.

**Height board of UNICEF:** The height of children was measured to the nearest 0.1 cm for the precision of the results. For children 6 to 23 months, measurement was taken by lying down on a horizontal measuring board (recumbent length), and height was measured by standing for 24 to 59 months children.

**Seca digital weighing machine:** The weight of children was measured to the nearest 100 grams or 0.1kg. Scales were checked for accuracy before and after

each day of measurement using weight of two kilograms or more. It had a capacity of 2 to 150 kilograms. It was placed on a flat surface and calibrated to zero before each measurement. The scale is also known as “2 in 1” as when we press the bottom it allows the scale to zero of the mother’s weight showing the weight of the child’s only. For accurate weight measurements on SECA digital weighing machines, children’s outer clothing was removed with barefoot.

**Validity and reliability:** External validity was ascertained by random sampling and by obtaining an adequate sample size while internal validity was ensured by adopting a standard questionnaire from NDHS-2016 with necessary modifications. The anthropometric measurement was carried out as per national guidelines based on WHO recommendations. Scales were checked for accuracy before and after each day of measurement using a weight of two kilograms or more. It was calibrated to zero before each measurement. To ensure reliability, pre-testing of the tools was done in 10 percent of the total sample in a similar Panchapuri Municipality at Surkhet and necessary modification was done. Data editing was done at the spot and in the evening of the same day to detect errors and to make sure data was consistent and well arranged. Additionally, the weight of the children was measured to the nearest 0.1 kg on a Seca digital weighing scale, and the height of the children was measured to the nearest 0.1 cm for the precision of the results.

**Study site and population:** The study was conducted in Panchapuri municipality, situated in Surkhet District, Karnali Province, Nepal. With a total area of 329.9 square kilometers and a population of 32,231 individuals, the municipality is divided into 11 wards. The study population comprised children aged 6 to 59 months and their mothers or caretakers, with households as the sampling unit. The sampling strategy involved cluster sampling, with each ward serving as a cluster, to achieve a representative sample size across the municipality. Considering the non-response rate of 5%, the sample size was 168. In Nepal, including Panchapuri Municipality, Surkhet, specific challenges related to WASH and nutrition, such as inadequate access to clean water and sanitation facilities, poor hygiene practices, or malnutrition, are prevalent.<sup>(13)</sup> guidelines and acts for the last two decades. But WASH situation of Nepal has not been well documented so far. Aim of this article is to describe the situation of water supply, sanitation and hygiene (WASH).

**Data management and analysis:** Data quality was ensured through rigorous procedures, including real-time checking for completeness during collection, immediate editing, coding, and entry into EpiData 3.1 software. After cleaning, the data was transferred to the

Statistical Package for Social Science (SPSS) for analysis. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were calculated. Binary logistic regression was applied to explore associations between dependent and independent variables. Bivariate logistic regression tested significant associations, with subsequent inclusion of significant variables in multivariate logistic analysis to adjust for confounding factors. Odds ratios (OR) and 95% confidence intervals (CI) were utilized to determine statistical significance ( $p < 0.05$ ).

**Ethical consideration:** Ethical approval was taken from the Institutional Review Committee of the Institute of Medicine. Before starting the data collection, approval was taken from the Panchapuri Municipality office and concerned wards. Likewise, written informed consent was taken from the mother or caretaker of each participant.

## RESULTS

### Socio-demographic characteristics

The socio-demographic characteristics are presented in Table 1. The average age of the mothers participating in the study was  $24.92 \pm 4.98$  years with a maximum (46.4%) of the mothers falling in the 20-24 years age category, followed by the 24-29 years age category (23.2%). The majority of the respondents (38.1%) were Brahmin/Chhetri caste followed by Janajati (30.4%). Almost 95% of the respondents followed Hinduism as their major religion followed by Buddhist (5.4%) religion where the respondents belong least. About 16% of the families were nuclear type whereas most of the families (84.5%) were of joint type. More than half of the total mothers (58.9%) had secondary-level education, followed by primary-level education (20.2%) while only 10% of mothers were found to be illiterate. The majority of the mothers were found to be engaged in agricultural activities accounting for 67.9% and about one-fourth of the mothers (23.2%) were found to be engaged in daily wage labor while only about 9% of mothers were found in Business.

### Maternal and child characteristics

This study found that the maximum number of children (98.8%) were born in health facilities while 1.2% of mothers had given birth to their children at home. Among the mothers who gave their child birth in health facilities most of the mothers (97.6%) went to government health facilities for the delivery of a child. Similarly, it was found that half of the total mothers had more than 3 children and almost one-fourth of the mothers had two children whereas about 24% of the mothers had only one child (Table 2).

**Table 1. Socio-demographic characteristics of the respondents**

Characteristics (n=168)	Number	Percentage
<b>Age of the mother (years)</b>		
15-19	20	11.9
20-24	78	46.4
25-29	39	23.2
30+	31	18.5
Average age (24.92±4.98) years		
<b>Age of the child (months)</b>		
6-11	72	42.9
12-23	51	30.4
24-35	26	15.5
36-47	19	11.3
Average age (19.44±13.07) months		
<b>Ethnicity</b>		
Brahmin/Chhetri	64	38.1
Janajati	51	30.4
Dalit	47	28.0
Others	6	3.6
<b>Religion</b>		
Hinduism	159	94.6
Buddhism	9	5.4
<b>Family Type</b>		
Joint family	142	84.5
Nuclear family	26	15.5
<b>Educational status of mother</b>		
Illiterate	17	10.1
Primary Education	34	20.2
Secondary Education	99	58.9
Higher Secondary Education	18	10.7
<b>Occupation of mother</b>		
Agriculture	114	67.9
Daily wages labor	39	23.2
Business	15	8.9

### Health status of 6-59 months children

Table no. 3 shows the health status of the child participating in the study. When asked to recall any illness in children in 2 weeks prior to the study, almost 93% of the total children had no illness whereas only 7% of children suffered from illness before the study. 83.33% of the mothers sought treatment for their ill child at a health facility, while only about 17% of mothers had treatment for their ill child at home. Among those who visited a health facility for treatment, 70% of ill children were diagnosed with diarrhea.

**Table 2. Maternal and child characteristics**

Characteristics (n=168)	Number	Percentage
<b>Sex of the child</b>		
Male	104	61.9
Female	64	38.1
<b>Place of delivery</b>		
Health facility	166	98.8
Home	2	1.2
<b>Number of children</b>		
1	40	23.8
2	44	26.2
3 or more	84	50
<b>Types of Health institution (n=166)</b>		
Government	162	97.6
Private	4	2.4

**Table 3. Health status of the 6-59 months children**

Characteristics n=168	Number	Percentage
<b>Recall illness in last 2 weeks</b>		
Yes	12	7.1
No	156	92.9
<b>Place for treatment (n=12)</b>		
Health facility	10	83.33
Home	2	16.67
<b>Disease diagnosed (n=10)</b>		
Diarrhoea	7	70
Amoebic Dysentery	2	20
Typhoid Fever	1	10

### Characteristics related to water

Table no. 4 shows the information about the water-related characteristics of the households involved in the study. Most of the households (81.5%) had safe sources of drinking water whereas 18.5% of households were found to use unsafe sources of drinking water. The majority of households (62.5%) didn't use any methods of water purification before drinking or using the water for cooking purposes. Among the household that uses any method of water purification, most households (66.67%) preferred boiling for water purification followed by chlorination as a means of water purification.

### Characteristics related to sanitation and hygiene

Table no. 5 exhibits the sanitation and hygiene-related characteristics of all 168 children included in the analysis. All the households (100%) had toilets. Among the households having toilets, it was found that almost 90% of households used an improved type of toilet. Child feces were disposed of in a toilet by parents in most of the households (84%). This study shows that all households had handwashing stations in their houses. More than 75% of households had both soap and water.

About 80% of the households segregate the solid waste. Solid waste from about 80% of households was managed by burning whereas 6.5% of households threw the waste in an open place. Half of the total households managed the liquid waste in kitchen gardens whereas about 39% of households drained the liquid waste in rivers and streams and only about 11% of households drained waste water in an open place. As per the findings from the observation checklist, more than 80% of household toilets were found clean.

**Table 4. Characteristics related to water**

Characteristics (n =168)	Number	Percentage
<b>Source of drinking water</b>		
Safe tap water	137	81.5
Unsafe tube well water	31	18.5
<b>Water Purification</b>		
Yes	63	37.5
No	105	62.5
<b>Methods of Purification (n=63)</b>		
Boiling	42	66.67
Chlorination	11	17.46
Filtration	10	15.87
<b>Water storage</b>		
Covered	156	92.9
Not covered	12	7.1

**Table 5. Sanitation and hygiene related characteristics of the respondents**

Characteristics (n=168)	Number	Percentage
<b>Type of Toilet</b>		
Improved	152	90.5
Unimproved	16	9.5
<b>Disposal method of child feces</b>		
Disposed in toilet	141	83.9
Dispose in Pit	17	10.1
Threw in open places	10	6.0
<b>Material used for handwashing</b>		
Water and Soap	129	76.8
Water only	39	23.2
<b>Segregation of solid waste</b>		
Yes	135	80.4
No	33	19.6
<b>Solid waste disposal</b>		
Burn	134	79.8
River/Stream	23	13.7
Throw anywhere	11	6.5

#### Liquid waste disposal

Kitchen garden	84	50.0
Drain to River/Stream	65	38.7
Drain in open place	19	11.3

#### Cleanliness inside toilet

Clean	138	82.1
Unclean	30	17.9

#### Nutritional status of the children

Table no. 6 shows the nutritional status of the children participating in the study. Among all the 6-59 months age children involved in the study, found that the prevalence of wasting, stunting, and being underweight is 4.8% (95% CI:1.57%-8.03%), 12.5% (95% CI: 7.5%-17.5%), and 6% (95% CI:3.21%-9.43%) respectively. The average height and weight of the participating child were 78.46±23.03 cm and 9.78 ± 4.84 kg respectively.

**Table 6. Nutritional status of 6-59 months children (n =168)**

Characteristics	Number	Prevalence	95% CI
Stunting	21	12.5	7.5-17.5
Underweight	10	6	3.21-9.43
Wasting	8	4.8	1.57-8.03

#### Association of WASH with underweight children between 6-59 months of age

Table no. 7 shows the bivariate analysis between water, sanitation, and hygiene characteristics with underweight children among 6-59 months age. About 19% of the underweight children were found in households having unimproved toilet facilities which was found statistically significant. Similarly, one-fourth of the underweight children were found in the household where the drinking water was protected. These associations were found statistically significant. Almost 14% of the underweight children were found in the household having no household sanitation though it was not found statistically significant.

#### Association of WASH with wasting of children between 6-59 months of age

This table 8 shows the bivariate analysis between WASH characteristics with underweight of children among 6-59 months. 6.3% of the wasting children were found in the household having unimproved toilet facilities. About 7% of wasting children were found in the household having unclean toilets. Almost 17% of the wasting children were found in the household where drinking water was protected. Similarly, about 23% of the wasting children were found in the household having no household sanitation.

**Table 7. Association of WASH characteristics with underweight of children among 6-59 months age**

Characteristics (n=168)	Weight for age		Chi-square	p-value
	Normal (%)	Underweight (%)		
<b>Type of toilet</b>				
Improved	145	7(4.6)	5.17	0.02*
Unimproved	13(81.3)	3(18.8)		
<b>Toilet sanitation</b>				
Unclean	28(93.3)	2(6.7)	0.03	0.85
Clean	130(94.2)	8(5.8)		
<b>Water purification</b>				
Yes	59(93.7)	4(6.3)	0.02	0.86
No	99(94.3)	6(5.7)		
<b>Water protection</b>				
Not protected	9(75)	3(25)	8.37	0.004*
Protected	149(95.5)	7(4.5)		
<b>Household sanitation</b>				
Yes	139(95.2)	7(4.8)	2.67	0.10
No	19(86.4)	3(13.6)		

\* Indicates statistically significant (p<0.05)

**Table 8. Association between WASH characteristics with wasting of children among 6-59 months.**

Characteristics (n=168)	Weight for height		Chi-square	p-value
	Normal (%)	Wasting (%)		
<b>Type of toilet</b>				
Unimproved	15(93.8)	1(6.3)	0.08	0.76
Improved	145(95.4)	7(4.6)		
<b>Toilet sanitation</b>				
Unclean	28(93.3)	2(6.7)	0.29	0.58
Clean	132(95.7)	6(4.3)		
<b>Water purification</b>				
Yes	60(95.2)	3(4.8)	0.001	1.23
No	100(95.2)	5(4.8)		
<b>Water protection</b>				
Not Protected	10(83.3)	2(16.7)	4.03	0.32
Protected	150(96.2)	6(3.8)		
<b>Household sanitation</b>				
Yes	143(97.9)	3(2.1)	18.01	0.13
No	17(77.3)	5(22.7)		

## Association of WASH with stunting of children between 6-59 months of age

Table No. 9 shows the association of water sanitation and hygiene-related variables with stunting 25% of stunted children were found in the household having unimproved toilet facilities. About 17% of the stunted children were found in the household having unclean toilets. Similarly, 27.3% of the stunted children were found in the household having no household sanitation.

**Table 9. Association of WASH characteristics with stunting of children among 6-59 months of age.**

Characteristics (n=168)	Height for age		Chi-square	p-value
	Normal (%)	Stunting (%)		
<b>Type of toilet</b>				
Unimproved	12(75)	4(25)	2.52	0.11
Improved	135(88.8)	17(11.2)		
<b>Toilet sanitation</b>				
Unclean	25(83.3)	5(16.7)	0.58	0.44
Clean	122(88.4)	16(11.6)		
<b>Water purification</b>				
Yes	57(90.5)	6(9.5)	0.81	0.36
No	90(85.7)	15(14.3)		
<b>Water protection</b>				
Protected	136(87.2)	20(12.8)	0.20	0.65
Not Protected	11(91.7)	1(8.3)		
<b>Household sanitation</b>				
Yes	131(89.7)	15(10.3)	5.05	0.21
No	16(72.7)	6(27.3)		

## Association of significant characteristics with underweight children

The multivariate analysis did not show a significant association with any variables. The table 10 below explains that the children in households having unimproved toilet facilities were about 5.13 times more likely to be underweight (AOR=5.13, 95% CI=0.89-29.99) than those children in households having improved toilets. Likewise, in the households having no water protection practices the children were about 1.97 times more likely to be underweight (AOR=1.97, 95% CI) than the children in the households having water protection practices. The Nagelkerke R square value 0.121 indicates that a 12.1% change in the dependent variable (underweight) was explained by the independent variables.

Based on the findings, the logistic regression equation for predicting underweight status from independent variables can be derived as follows:

$$Z = (-3.246) + (1.311) X_1 + (1.746) X_2$$

Where,

$X_1$  = Toilet Type

$X_2$  = Water Protection

**Table 10. Factor associated with underweight children from multivariate logistic regression**

Characteristics	Unadjusted OR (95%CI)	Adjusted OR (95% CI)	p-value
<b>Toilet type</b>			
Improved	Ref	Ref	
Unimproved	4.78(1.10-20.72)	5.13(0.89-29.99)	0.09
<b>Water protection</b>			
Yes	Ref	Ref	
No	0.94 (0.28-1.91)	1.97 (0.82 – 4.76)	0.13

Nagelkerke R2 value=0.121

## DISCUSSION

### Nutritional status of the children

Nepal demographic and health survey reports that 36 percent of children under age 5 are stunted, 10 percent are wasted and 27 percent are underweight. (10) The prevalence of stunting (12.5%), wasting (4.8%), and underweight (6%) as obtained in the study were relatively lower than the national surveys conducted. (10) This shows that the Multi-Sectoral Nutritional Plan-II (MSNP-II), with a key objective of improving the nutritional status of adolescent girls, pregnant and lactating women, and all children under 24 months, is reaching these slums as well. Therefore, the lower prevalence of under-nutritional deficiencies could be attributable to the implementation of the MSNP-II in Nepal. The MSNP-II could have improved nutritional status in Panchapuri Municipality, Surkhet by implementing interventions to improve access to nutritious food and health and sanitation practices. (11) Wasting is the result of acute undernutrition, while stunting is the result of chronic undernutrition, and underweight is the result of both acute and chronic undernutrition. The first 1000 days of life is the time when there is a high risk for the development of nutritional deficiencies, which continues in childhood. (14)

Though the sex of the child did not show any association with nutritional status in the study boys are found at a higher risk for stunting than girls in other related studies. Such findings could be the result of biological fragility or may be due to feeding practice

and preferences and types of exposure directed more towards the male child. Hence the findings of the study conflict with other studies on stunting. (15) Parental education status has been associated with children's underweight in much of the literature as it is argued that parents with higher educational status have a better ability to make a decision that improves the nutritional status of children. However, the current study shows no such associations. (16) The nutritional status of children born at home tends to have poorer nutritional status as compared to the ones delivered at health facilities. Maternal education improves child nutrition through better dietary choices, caregiving, hygiene practices, healthcare use, and community advocacy, mitigating poor WASH conditions' effects. (17) This in turn reduces the capabilities to make informed choices, and also miss out on postnatal counseling which helps in improving the nutritional status of both mother and child. (18) The study done in Madhyapur Thimi municipality found that 19.6% of adolescents were overweight, compared to 8.5% who were underweight, with poor dietary habits, frequent junk food consumption, and limited physical activity contributing to these trends. Key factors influencing overweight status included the mother's occupation, fruit avoidance, exposure to food advertisements, and junk food consumption, highlighting the need for targeted interventions to promote healthier lifestyles among adolescents. (19)

### Nutritional status and water, sanitation and hygiene

There was also no statistically significant association between stunting and the availability of improved water and sanitation at the household level in one of the studies with secondary data analysis. Interestingly, most of the interventions are focused on improving hygiene and preventing the spread of disease and infections regarding nutritional status. It is said that nutrition and health have direct effects on child outcomes. (20,21) Where a main link connecting to it is water sanitation and hand washing techniques which are concerned with care practices delivered by the parents or caregiver. Combined interventions in preconception health can be more effective than individual strategies. Multi-level interventions, participatory learning and action, and social movement support are key to success. (22) Engaging with commercial interests can also strengthen the capacity to deliver effective interventions. (23)

Here, the present study shows that almost sixty-two percent of the respondents still do not use any method of water purification and the boiling technique is adopted by sixty-seven percent among those who drink purified water. Literature has claimed that children whose mothers use untreated water suffer more from diarrhea.



Poor water quality, inconvenient water point location, and weak institutional capacity are still the major issues related to drinking water in Nepal. So, as the safe water also has the potential of getting contaminated with feces during its transport, collection, or storage at the household level, mothers and caregivers should be exposed to health promotion interventions and hygiene methods so as to reduce childhood disease and morbidity.(24) The association of wasting has been rarely linked to access to improved water and toilets but in Vietnam, improved water has shown an association with lesser risk of stunting. Research conducted in India showed that household access to an improved source of drinking water or piped water was not associated with childhood stunting. This result does support the findings from my study and it was a cross-sectional analysis of three large survey data.(25)

Likewise, the prevalence of undernutrition among under-five children was found associated with poor WASH practice in one of the studies conducted in Tanzania, this could be due to the different sociocultural factors and communities.(24) A study conducted in Peru had similar findings as the study and stated that poor water source, sanitation, or storage could lead to stunting among children under two years of age. So water purification and the use of related techniques have been suggested in many literatures. Similarly, a study conducted in Bangladesh also supported the findings as it quoted about the need for better water quality, and improved toilets. And hand washing facilities that could lead to lesser chances of undernutrition.(26)

The prevalence of acute malnutrition has been seen higher in boys compared to their female counterparts as per the literature reviews. The current study also has similar findings pointing to the disparity between boys and girls. One of the reasons for such disparity is due to socio-economic and cultural practices or care practices or care practices of different communities. For example, in Niger, there are more cases of wasting among boys than that of girls, as during pregnancy period. The boy child is looked after by the caretakers and the girl child by the mother herself.(27)

## CONCLUSION

This study highlights the interplay of socio-demographic, health, WASH, and nutritional factors influencing the health and nutritional status of children aged 6-59 months. Their association with nutritional status was also observed. Nutritional indicators showed that relatively low children were wasted, and some were stunted and underweight, reflecting underlying health and nutrition concerns. While illness prevalence among

children was low, diarrhea was the most common diagnosis among those who were sick. Bivariate analysis revealed significant associations between unimproved toilet facilities and underweight, wasting, and stunting, as well as associations with protected drinking water and household sanitation practices. However, multivariate analysis did not show statistically significant associations, though trends indicated higher odds of being underweight in households with unimproved toilets and a lack of water protection practices. These findings emphasize the need for targeted interventions to improve WASH infrastructure and practices, along with integrated programs addressing socio-demographic factors, maternal education, and access to healthcare, to promote better health and nutritional outcomes for children. The decreasing prevalence shows that the MSNP with the key objective of improving the nutritional status of adolescent girls, pregnant and lactating women, and all children under 24 months, is reaching this municipality as well. Therefore, the lower prevalence of under-nutritional deficiencies could be attributable to the implementation of the MSNP in Nepal. To reduce the burden of early malnutrition, strategies that are focused on the accessibility of clean drinking water, improvement of toilets, management of waste, and awareness related to handwashing are needed.

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## Conflict of Interest

The authors declare no conflict of interest.

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